



Continuous Performance Monitoring in Buildings

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Introduction

Commercial buildings account for about 40 percent of the total energy consumption in the country. This is expected to increase to 76% by 2040. Also, energy consumption growth in India is projected to increase at an average rate of 5% each year, which is the world's highest. We realized that these issues have significant implications on energy management strategies in the building industry. Thus, it was decided to undertake proactive steps to address these challenges and achieve the highest levels of resource efficiency.

The only way to achieve this was to ensure efficient operations on a continuous basis by monitoring operational data pertaining to resource consumption. Thus, we set up the first-of-its-kind central command center in Bangalore, enabling remote monitoring and optimization of building operations of Infosys across India.

The state-of-the-art command center manages about 138 buildings, covering about 45 million sqft of built-up area across different campuses in India from one single place. Data flowing into the command center from various systems is used to review and optimize operations, drive resource conservation, perform

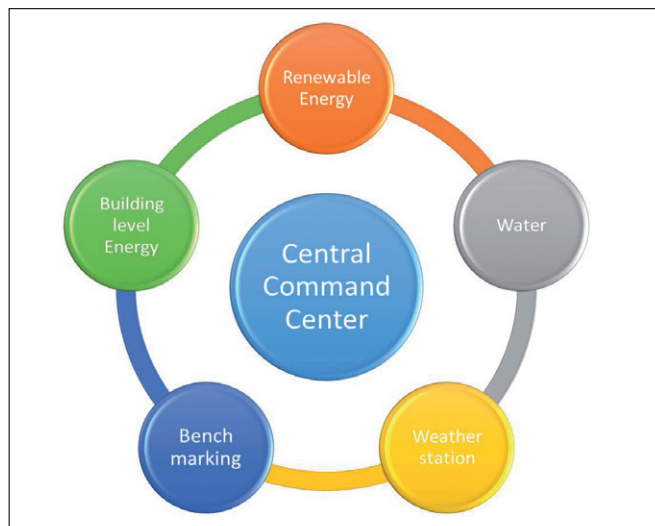


Figure 1: Central command center at Bangalore

About the Authors

The authors are part of the Green Initiatives at Infosys.

fault detection and diagnostics, and ensure high level of comfort and indoor air quality to our employees. *Figure 1* shows the areas managed by the central command center.

Innovative Features

Typically, in the building industry, operations are managed by low skill manpower. Most of the operations are manual and the possibility of errors or inaccuracy tends to be high. Instead of defined algorithms or performance parameters driving systems like air conditioning, lighting, etc., it is the understanding of the system by the operators that drives the system efficiency or optimization.

With the central command center, Infosys has set new standards by having skilled subject matter experts managing operations remotely and ensuring high performance of the system on a continuous basis. Below are some of the innovative features of this center.

- Common platform for managing resource efficiency
- Facilitates comparison between different campuses and buildings/facilities
- Helps in sharing experiences and best practices between different campuses
- Makes it easy to rollout initiatives on operations across the organization quickly and effectively
- Manage energy by detail – for lighting, computing and plug loads – floor-wise and wing-wise energy monitoring for lighting, computing and plug loads for granular energy control, identification of wastage, employee awareness
- Continuous measurement and verification by SMEs
- Provides data to optimize future building designs
- Allow equipment and system level diagnostics and correction
- Enables trending and data analytics
- Monitors energy and water consumption on hourly, daily and monthly basis for optimization

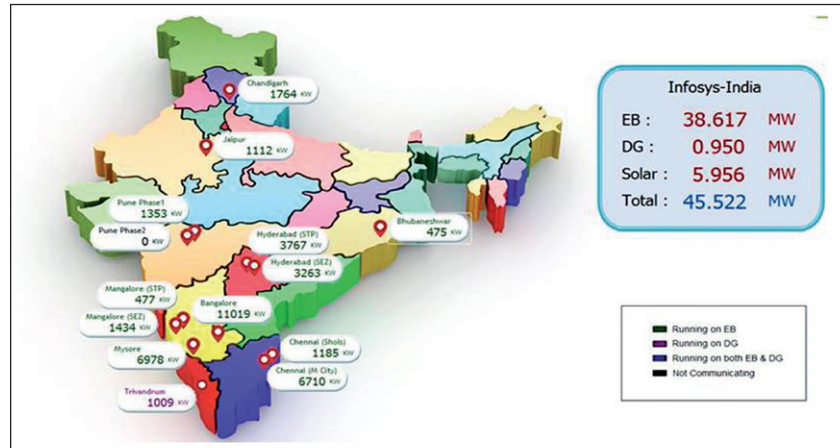


Figure 2: Sample data

Benefits

Benefits to the Organization

- Increased transparency and credibility

The command center gives data on all campuses and buildings to all stakeholders at any time of the day. Anyone, from a facility manager to our senior management, can look at any of our campuses from one location and get current and past data on energy, water consumption, etc. immediately. This also gives an opportunity to compare energy consumption between two buildings, or campuses of different weather conditions on one single screen. With this, we have the ability to demonstrate what is feasible with accurate data to back our achievements, thereby adding credibility and transparency.

- Granular level monitoring by building experts

It helps us monitor our energy consumption at a granular level. Today, buildings are mostly managed by unskilled facilities personnel, but with the command center it enables us to have building efficiency experts manage operations, remotely provide technical expertise for all locations that is currently unavailable in the industry, and analyze data to identify optimization opportunities. Centralized expertise is allowing us to smarten our diagnostic

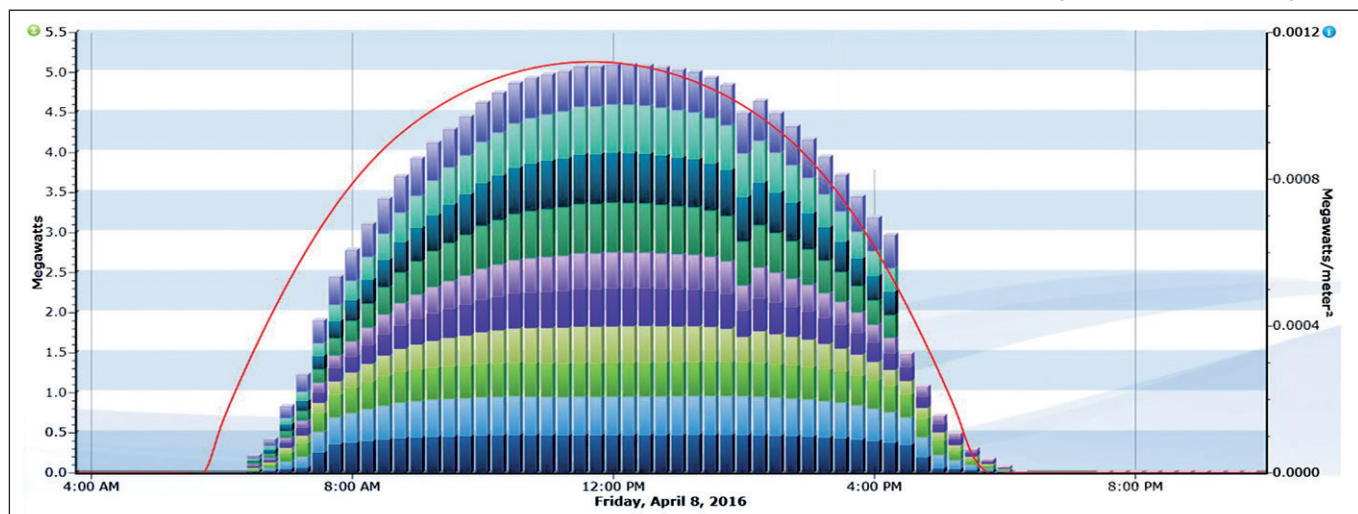


Figure 3: Solar energy generation data

capability and hence enhance operational effectiveness. This capability is not just limited to diagnostics, but extends up to recommendations for new building designs. This changes the whole landscape of building operations and has the ability to transform the way we operate and build buildings not only in India but across the world.

- *High performance buildings*

All the design and retrofit decisions for new as well as existing buildings are data and performance driven and not based on assumptions or thumb rules. Through continuous performance monitoring and verification, we have been able to implement and optimize solutions, leading to buildings that are highly efficient, cost effective to build and operate and also provide a comfortable, healthy and safe environment for employees. It is only our data driven approach that has helped us achieve significant energy savings and devise high performance buildings across campuses in India.

- *Ease of operations and maintenance*
- *Empowering facilities team with operational data*
- *Energy cost savings*
- *Higher comfort level for employees due to more accurate operations*

Benefits to the Society and Environment

- Significant reduction in carbon emissions
- Reduced pressure on the limited natural resources
- Increase in availability of electricity for others to consume
- Improved work environment for employees
- Enhanced indoor air quality
- Employee health, productivity and comfort

Conclusion

We believe that 'you can only manage what you can measure'. The central command center has helped us reduce our energy consumption significantly, expanding the availability of energy for others to use. We have reduced our per capita electricity consumption by 49% in the last eight years. This has been achieved through focused efforts on sustainable designs, technologies, and operational efficiency, which have been driven mainly by continuous data monitoring through the central command center.

It demonstrates a strong business case for the commercial building sector in India. If continuous energy data monitoring is implemented in the commercial buildings of our country, our national level building performance can be brought down from 180 kWh/m²/year to 100 kWh/m²/year, even lesser than the national target of 110 kWh/m²/year. This would be a huge contribution to the environment and society.

Our data driven case studies have the potential of becoming mainstream in the coming years. They will play an important role in redefining benchmarks for environment sustainability. Central command center's online smart energy monitoring has helped us through continuous monitoring.

